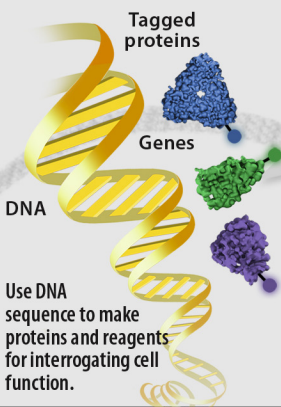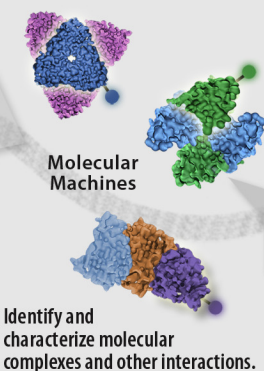# GTL Facilities: Accelerating Scientific Discovery and Applications Research for Energy and Environment
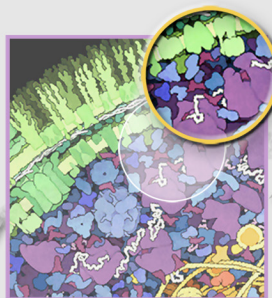
Protein Production and Characterization

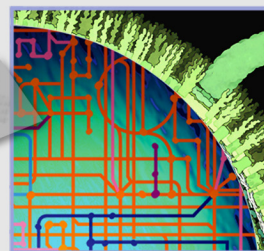
Tagged proteins

Genes

DNA

Use DNA sequence to make proteins and reagents for interrogating cell function.

Molecular Machines

Molecular Machines

Identify and characterize molecular complexes and other interactions.

Proteomics

Identify proteins and other molecules produced by cells in response to environmental cues.

Cellular Systems

Achieve an in silico, predictive understanding of microbes in their natural environments.

Production and Characterization of Proteins and Molecular Tags

▶ Produce proteins encoded in the genome.

▶ Create affinity reagents that allow each protein to be identified, located, and manipulated in living cells.

▶ Perform biophysical and biochemical characterizations of proteins produced to gain insights into function.

Characterization and Imaging of Molecular Machines

▶ Isolate and analyze molecular machines from microbial cells.

▶ Image structure and cellular location of molecular machines.

▶ Generate dynamic models and simulations of molecular machines.
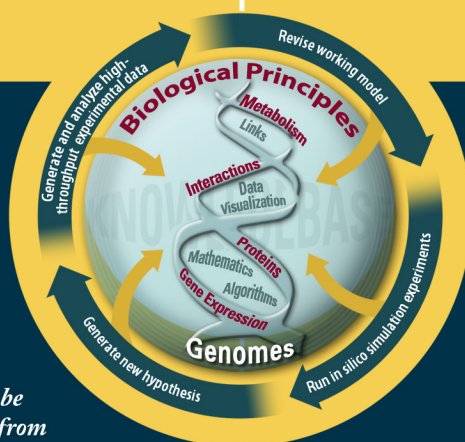
Whole Proteome Analysis

▶ Measure molecular profiles and their temporal relationships.

▶ Identify and model key pathways and other processes to gain insights into functions of cellular systems.

Modeling and Analysis of Cellular Systems

▶ Integrate knowledge and models to understand the structure and functions of cellular systems, from single cells to complex communities.

▶ Integrate imaging and other technologies to analyze molecular species from subcellular to ecosystem levels as they perform their functions.

Understanding how the information in a genome dictates cellular functions requires knowledge of a cell's molecular complement, interactions, and regulation. These studies must be carried out on a scale far exceeding today's capacities.

Microbial genome sequences will be the foundation on which all data from the large–scale GTL facilities (described above) are related.

Biological Principles

Revise working model

Generate and analyze high-throughput experimental data

Metabolism

Links

Interactions

Data Visualization

Mathematics

Proteins

Gene Expression

Algorithms

Genomes

Generate new hypothesis

Run in silico simulation experiments

▶ Comprehensive integration of GTL and research community databases

▶ Transparent and intuitive access to computational tools

▶ Simulations of microbial behavior using genome sequences as input

▶ Information and support for research, policy, and applications

Systems Microbiology Knowledgebase to Enable a Predictive Understanding of Microbes and Communities